

Ground Water Cleanup Levels

Table 720-1

DEPARTMENT OF ECOLOGY

February 9, 2001

TO: Interested Persons

FROM: Pete Kmet, Senior Environmental Engineer
Toxics Cleanup Program

SUBJECT: Calculations for Table 720-1
Method A **Ground Water** Cleanup Levels

Attached are several spreadsheets providing background information leading to the Method A ground water cleanup levels in Table 720-1. These tables include:

- Table 1: A “**quick summary**” illustrating the current Method A ground water cleanup levels, proposed ground water cleanup levels and a brief explanation of the reasoning for the new Method A values. The values that are proposed to be changed are highlighted with boxes.
- Table 2: A **detailed compilation** of the information considered in the development of the Method A ground water cleanup levels. This includes: The current federal or state drinking water standard (MCL), the Method B drinking water value for each substance (both as a carcinogen and noncarcinogen), the practical quantitation limit, the pure substance solubility limit, and other relevant information such as natural background and odor thresholds, where available.
- Table 3: Provides the assumptions used in calculating the Method B drinking water values for noncarcinogens.
- Table 4: Provides the assumptions used in calculating the Method B drinking water values for carcinogens.

Table 1: Quick Summary -- Basis for Method A Groundwater Table Values

Parameter	CAS No.	Current Method A ug/l	Proposed Method A ug/l	Basis for Proposed Cleanup Level
Arsenic Benzene	7440-38-2 71-43-2	5 5	5 5	Natr'l bkgd--MCL exceeds allowable risk. MCL
Benzo(a)Pyrene Cadmium	50-32-8 7440-43-9	none 5	0.1 5	MCL adjusted to 1 X 10-5 risk. This can also be used as the total toxic equivalents for all cPAHs. See WAC 173-340-708(8). MCL
T Chromium Chromium VI Chromium III	7440-47-3 18540-29-9 16065-83-1	50 none none	50 none none	Method B--based on Chromium VI. If just Cr (III) is present, can use 100 ug/l.
DDT 1,2 Dichloroethane	50-29-3 107-06-2	0.1 5	0.3 5	Method B (current Method A value appears to be in error) MCL
Ethylbenzene Ethylene dibromide (EDB)	100-41-4 106-93-4	30 0.01	700 0.01	MCL Method B adjusted to PQL--MCL exceeds allowable risk.
Lead Lindane	7439-92-1 58-89-9	5 0.2	15 0.2	MCL MCL
Methylene chloride Mercury (inorganic)	75-09-2 7439-97-6	5 2	5 2	MCL MCL
MTBE Naphthalenes	1634-04-4 91-20-3	none none	20 160	Lower limit of EPA Advisory level Method B for naphthalene. This is a total of all naphthalene, 1-Methyl naphthalene & 2-Methyl Naphthalene in the water.
PAHs(carcinogenic)(1) PCB mixtures	na 1336-36-3	0.1 0.1	none 0.1	Replaced by Benzo(a)Pyrene, above. Method B adjusted to PQL (MCL exceeds MTCA allowable HQ and cancer risk). This is a total for all PCBs.
Tetrachloroethylene (PCE) Toluene	127-18-4 108-88-3	5 40	5 1000	MCL MCL
TPH (total)	14280-30-9	1,000	none	Replaced with TPH for specific products.
Gasoline GRO w/o benzene GRO with benzene Diesel Heavy Oils Electrical Insulating Oil	6842-59-6		1,000 800 500 500 500	Equation 720-3, assuming no benzene is present in gasoline contaminated water. Equation 720-3, assuming benzene restored to 5 ug/l. Equation 720-3. Equation 720-3. Equation 720-3.
1,1,1 Trichloroethane Trichloroethylene	71-55-6 79-01-6	200 5	200 5	MCL MCL
Vinyl Chloride Xylene (total)	75-01-4 1330-20-7	0.2 20	0.2 1000	MCL adjusted to 1 X 10-5 risk. Not to exceed total TPH for gasoline & aesthetic considerations (odor)
Gross Alpha Particle Act. Gross Beta Particle Act.		15 pCi/l 4 mrem/yr	15 pCi/l 4 mrem/yr	MCL. MCL (4 mrem/yr equals 50 pCi/l)
Radium 226 & 228 Radium 226		5 pCi/l 3 pCi/l	5 pCi/l 3 pCi/l	MCL MCL

Table 2: Summary Table for Method A Ground Water Values in Table 720-1

Basis for Method A Ground Water Table Values			MTCA			Solubility		
Parameter	CAS No.	MCL ug/l (1)	Method B Carc. ug/l (2)	Method B NonC.ug/l (3)	Risk @ MCL HQ @ MCL (4)	PQL ug/l (5)	Limit ug/l (6)	Other ug/l (7)
Arsenic	7440-38-2	50	0.058	4.8	8.6x10-4/10	2 (SW7060)		5 (natr'l bkgd)
Benzene	71-43-2	5	1.5	24	3.3X10-6/0.21	1 (SW8260B)	1,750,000	1,100 (odor)
Benzo(a)Pyrene	50-32-8	0.2	0.012		1.7X10-5	0.02 (SW8270C SIM)	1.6	
Cadmium	7440-43-9	5		8.0	0.62	0.1 (SW7131)		
T Chromium	7440-47-3	100			2.1	5 (SW6010A)		
Chromium VI	18540-29-9	none		48		2 (SW7196)		
Chromium III	16065-83-1	none		24,000		5 (SW6010A)		
DDT	50-29-3	none	0.26	8.0		0.1 (SW8081)	25	
1,2 Dichloroethane	107-06-2	5	0.48		1X10-5	1 (SW8260B)	8,520,000	
Ethylbenzene	100-41-4	700		800	0.88	1 (SW8260B)	169,000	120 (odor)
Ethylene dibromide (EDB)	106-93-4	0.05	0.00051		9.7X10-5	0.01 (EPA504.1)	4,000,000	
Lead	7439-92-1	zero/15				2 (SW7421)		5 (natr'l bkgd)
Lindane	58-89-9	0.2	0.067	4.8	3X10-6/0.04	0.1 (EPA504.1)	6,800	
Methylene chloride	75-09-2	5	5.8	480	8.6X10-7/0.1	1 (SW8260B)	13,000,000	
Mercury (inorganic)	7439-97-6	2		4.8	0.4	0.1 (SW7470)		
MTBE	1634-04-4	20-40				1 (SW8260B)	50,000,000	5 - 40 (odor)
Naphthalene	91-20-3	none		160		1 (SW8260B) (10)	31,000	15 (odor)
PAHs(carcinogenic)(8)	na	0.2	0.012		1.7X10-5	0.02 (SW8270C SIM)	1.6	
PCB mixtures(9)	1336-36-3	0.5	0.044	0.32	1.14X10-5/1.6	0.1 (SW8082)	12 to 57	
(1)	Maximum contaminant level from 40 CFR 141.61 and WAC 246-290-310 except for lead and MTBE. MTBE is an EPA Advisory range.							
(2)	Lead is the MCL goal of zero and the EPA action level from 40 CFR 141.80 for which no more than 10% of samples can exceed at the tap.							
(3)	Value calculated using equation 720-2 and cancer potency factor from IRIS or HEAST.							
(4)	Risk posed by MCL, calculated using equations 720-1 and 720-2. Non carcinogen related values are highlighted with bolding.							
(5)	From Manchester Laboratory.							
(6)	Source: EPA Soil Screening Guidance: Technical Background Document. EPA/540/R-95/12B. May, 1996, except EDB and PCB's from ATSDR Toxicological Profiles; and, MTBE from USGS final draft report on fuel oxygenates, March, 1996							
(7)	Odor threshold is median of values reported in literature. Background values for As and Pb from PTI, 1989.							
(8)	The cPAH values shown are based on benzo(a)pyrene.							
(9)	For PCBs, the noncarcinogenic risk is based on the Rfd for Arochlor 1254. The carcinogenic risk is based on the most potent CPF in IRIS.							
(10)	Use SW 8270C to measure all three types of naphthalene.							

Table 2: Summary Table for Method A Ground Water Values in Table 720-1

Basis for Method A Ground Water Table Values								
Parameter	CAS No.	MCL ug/l (1)	Method B Carc. ug/l (2)	Method B NonC.ug/l (3)	MTCA	PQL ug/l (5)	Solubility Limit ug/l (6)	Other ug/l (7)
					Risk @ MCL			
Tetrachloroethylene (PCE)	127-18-4	5	0.86	80	5.8X10-6/0.06	1 (SW8260B)	200,000	
Toluene	108-88-3	1,000		1,600	0.62	1 (SW8260B)	526,000	500 (odor)
TPH (total)	14280-30-9	none						
Gasoline	6842-59-6	none				250 (NWTPH-Gx)	~100,000	340 (odor)
GRO w/o benzene				1,000				
GRO with benzene				800				
Diesel		none		500		250 (NWTPH-Gx)	<1,000-5,000	200 (odor)
Heavy Oils		none		500		500 (NWTPH-Dx)	<1,000-6,300	500 (odor)
Electrical Insulating Oil		none		500		500 (NWTPH-Dx)	~1,000-1,700	2,500 (odor)
1,1,1 Trichloroethane	71-55-6	200		7200	0.028	1 (SW8260B)	1,330,000	
Trichloroethylene	79-01-6	5	4.0		1.3X10-6	1 (SW8260B)	1,100,000	
Vinyl Chloride	75-01-4	2	0.023		8.7X10-5	0.01 (SW8260B SIM)	2,760,000	
Xylene (total)	1330-20-7	10,000		16,000	0.62	3 (SW8260B)	176,000	760 (odor)
Gross Alpha Particle Act.		15 pCi/l				4 pCi/l		0.25-3 pCi/l (natr'l bkgd)
Gross Beta Particle Act.		4 mrem/yr				1 pCi/l		3-9 pCi/l (natr'l bkgd)
Radium 226 & 228		5 pCi/l				0.2-0.7 pCi/l		0.3 pCi/l (natr'l bkgd)
Radium 226		3 pCi/l						<0.3 pCi/l (natr'l bkgd)
(1) Maximum contaminant level from 40 CFR 141.61 and WAC 246-290-310.								
(2) Value calculated using equation 720-2 and cancer potency factor from IRIS or HEAST.								
(3) Value calculated using equation 720-1 and reference dose from IRIS or HEAST. Basis for TPH values is documented in a May 18, 1999 memo by Steve Robb.								
Gasoline w/benzene: Based on equation 720-3 using dissolved phase composition derived with 4 phase model adjusted for benzene being present at the MCL of 5 PPB.								
Gasoline w/o benzene: Based on equation 720-3 using dissolved phase composition derived with 4 phase model and assuming no benzene is present in water.								
Diesel: Based on equation 720-3 using dissolved phase composition derived with 4 phase model and in water/diesel partitioning experiment.								
Heavy Oil: Based on equation 720-3 using dissolved phase composition derived with 4 phase model and in water/diesel partitioning experiment.								
Mineral Oil: Based on equation 720-3 using dissolved phase composition derived with 4 phase model and in water/mineral oil partitioning experiment.								
(4) Risk posed by MCL, calculated using equations 720-1 and 720-2. Non carcinogen related values are highlighted with bolding.								
(5) PQLs from Manchester Laboratory, except radionuclides from Ecology's Nuclear Waste Program.								
(6) Source: EPA Soil Screening Guidance: Technical Background Document. EPA/540/R-95/12B. May, 1996, except TPH from various sources. The value for total xylenes is a weighted average of m, o & p xylene based on gasoline composition data from TPH Criteria Working Group--Vol. 2 (May, 1998).								
(7) Odor threshold is median of values reported in literature. Background for radionuclides from Ecology's Nuclear Waste Program.								

Table 2: Summary Table for Method A Ground Water Values in Table 720-1

Table 2: Summary Table for Method A Ground Water Values in Table 720-1

	Current Parameter	Proposed Method A	Basis for Proposed Cleanup Level
	ug/l	ug/l	
Tetrachloroethylene (PCE)	5	5	MCL
Toluene	40	1,000	MCL
TPH (total)	1,000	none	Replaced with TPH for specific products.
Gasoline			
GRO w/o benzene		1,000	Equation 720-3.
GRO with benzene		800	Equation 720-3.
Diesel		500	Equation 720-3.
Heavy Oils		500	Equation 720-3.
Electrical Insulating Oil		500	Equation 720-3.
1,1,1 Trichloroethane	200	200	MCL
Trichloroethylene	5	5	MCL
Vinyl Chloride	0.2	0.2	MCL adjusted to 1 X 10-5 risk.
Xylene (total)	20	1,000	Not to exceed maximum allowable total TPH for gasoline & aesthetic considerations (odor). This is the total of m, o & p xylenes.
Gross Alpha Particle Act.	15 pCi/l	15 pCi/l	MCL. [It is anticipated radionuclide cleanup standards will be subject to future review.]
Gross Beta Particle Act.	4 mrem/yr	4 mrem/yr	MCL (4 mrem/yr equals 50 pCi/l)
Radium 226 & 228	5 pCi/l	5 pCi/l	MCL
Radium 226	3 pCi/l	3 pCi/l	MCL

Table 3: Drinking Water -- Method B Calculations for Noncarcinogens

Risk Calculations--Noncarcinogenic Effects of Drinking Water Ingestion									Method B	MCL(3)	HQ @
Parameter	CAS No.	Reference	Avg. Body Dose (1) (mg/kg-day)	Unit Conv. Weight (kg)	Hazard Factor Quotient (unitless)	Drinking H2O Ing. Rate (liter/day)	Inhalation Corr. Factor (unitless)	Drinking H2O Fraction (unitless)	Noncanc(2) (ug/l)	MCL(4) (ug/l)	(unitless)
Arsenic	7440-38-2	0.0003	16	1,000	1	1.0	1	1.0	4.8	50	10
Benzene	71-43-2	0.003	16	1,000	1	1.0	2	1.0	24	5	0.2
Cadmium	7440-43-9	0.0005	16	1,000	1	1.0	1	1.0	8.0	5	0.6
T Chromium	7440-47-3	not available								100	
Chromium III	16065-83-1	1.5	16	1,000	1	1.0	1	1.0	24,000	none	
Chromium VI	18540-29-9	0.003	16	1,000	1	1.0	1	1.0	48	none	
DDT	50-29-3	0.0005	16	1,000	1	1.0	1	1.0	8.0	none	
1,2 Dichloroethane	107-06-2	not available								5	
Ethylbenzene	100-41-4	0.1	16	1,000	1	1.0	2	1.0	800	700	0.9
Ethylene dibromide (EDB)	106-93-4	not available								0.05	
Lead	7439-92-1	not available								zero / 15	
Lindane	58-89-9	0.0003	16	1,000	1	1.0	1	1.0	4.8	0.2	0.04
Methylene chloride	75-09-2	0.06	16	1,000	1	1.0	2	1.0	480	5	0.01
Mercury (inorganic)	7439-97-6	0.0003	16	1,000	1	1.0	1	1.0	4.8	2	0.4
MTBE	1634-04-4	not available								20-40	
Naphthalene	91-20-3	0.02	16	1,000	1	1.0	2	1.0	160	none	
cPAH Mixtures	na	not available									
Benzo[a]anthracene	56-55-3	not available									
Benzo[b]fluoranthene	205-99-2	not available									
Benzo[k]fluoranthene	207-08-9	not available									
Benzo[a]pyrene	50-32-8	not available								0.2	
Chrysene	218-01-9	not available									
Dibenzo[a,h]anthracene	53-70-3	not available									
Indeno[1,2,3-cd]pyrene	207-08-9	not available									
(1) Source of RfDs is EPA's IRIS database except for benzene which is from EPA's NCEA.											
(2) Value calculated using equation 720-1 and default assumptions in that equation.											
(3) Maximum contaminant level from 40 CFR 141.61 and WAC 246-290-310. Except for MTBE which is not an MCL but the EPA Advisory range.											
For lead, this is the MCL goal of zero and an EPA action level from 40 CFR 141.80, for which no more than 10% of water samples can exceed at the tap.											
(4) MCL divided by Method B value. Bolded values indicate MCL exceeds MTCA requirement that HQ not exceed 1.0.											

Table 3: Drinking Water -- Method B Calculations for Noncarcinogens

Risk Calculations--Noncarcinogenic Effects of Drinking Water Ingestion								Method B	MCL(3)	HQ @	
Parameter	CAS No.	Reference Dose (1) (mg/kg-day)	Avg. Body Weight (kg)	Unit Conv. (ug/mg)	Hazard Quotient (unitless)	Drinking H2O Ing. Rate (liter/day)	Inhalation Corr. Factor (unitless)	Drinking H2O Fraction (unitless)	Noncarc(2) (ug/l)	MCL(4) (ug/l)	(unitless)
PCB mixtures	1336-36-3	not available								0.5	
High Risk & Persistence		not available									
Low Risk & Persistence		not available									
Lowest Risk & Persistence		not available									
Aroclor 1016	12674-11-2	0.00007	16	1,000	1	1.0	1	1.0	1.1	0.5	0.4
Arochlor 1248	12672-29-6	not available									
Arochlor 1254	11097-69-1	0.00002	16	1,000	1	1.0	1	1.0	0.32	0.5	1.6
Arochlor 1260		not available									
Tetrachloroethylene (PCE)	127-18-4	0.01	16	1,000	1	1.0	2	1.0	80	5	0.1
Toluene	108-88-3	0.2	16	1,000	1	1.0	2	1.0	1,600	1,000	0.6
1,1,1 Trichloroethane	71-55-6	0.9	16	1,000	1	1.0	2	1.0	7,200	200	0.03
Trichloroethylene	79-01-6	not available								5	
Vinyl Chloride	75-01-4	not available								2	
Xylenes	1330-20-7	2.0	16	1,000	1	1.0	2	1.0	16,000	10,000	0.6
m-Xylene	108-38-3	not available									
o-xylene	95-47-6	not available									
p-xylene		not available									
Gross Alpha Particle Act.		not available								15 pCi/l	
Gross Beta Particle Act.		not available								4 mrem/yr	
Radium 226 & 228		not available								5 pCi/l	
Radium 226		not available								3 pCi/l	
(1) Source of RfDs is EPA's IRIS database except for 1,1,1 TCE, which is from HEAST											
(2) Value calculated using equation 720-1 and default assumptions in that equation.											
(3) Maximum contaminant level from 40 CFR 141.61 and WAC 246-290-310.											
(4) MCL divided by Method B value. Bolded values indicate MCL exceeds MTCA requirement that HQ not exceed 1.0.											

Table 4: Drinking Water -- Method B Calculations for Carcinogens

Risk Calculations--Carcinogenic Effects of Drinking Water Ingestion											
Parameter	CAS No.	Risk	Avg. Body Weight	Lifetime	Unit Conv.	Cancer Potency Factor	Drinking H ₂ O Ing. Rate	Duration of Exposure	Inhalation Corr. Factor	Drinking H ₂ O Fraction	Method B Carcinogen
		(unitless)	(kg)	(years)	(ug/mg)	(kg-day/mg)	(liter/day)	(years)	(unitless)	(unitless)	(ug/l)
											MCL(4)
Arsenic	7440-38-2	0.000001	70	75	1,000	1.5	2.0	30	1	1.0	0.058
Benzene	71-43-2	0.000001	70	75	1,000	0.029	2.0	30	2	1.0	1.51
Cadmium	7440-43-9					not available					5
T Chromium	7440-47-3										100
Chromium III	16065-83-1					not available					none
Chromium VI	18540-29-9					not available					none
DDT	50-29-3	0.000001	70	75	1,000	0.34	2.0	30	1	1.0	0.26
1,2 Dichloroethane	107-06-2	0.000001	70	75	1,000	0.091	2.0	30	2	1.0	0.48
Ethylbenzene	100-41-4					not available					700
Ethylene dibromide (EDB)	106-93-4	0.000001	70	75	1,000	85	2.0	30	2	1.0	0.00051
Lead	7439-92-1					not available					zero / 15
Lindane	58-89-9	0.000001	70	75	1,000	1.3	2.0	30	1	1.0	0.067
Methylene chloride	75-09-2	0.000001	70	75	1,000	0.0075	2.0	30	2	1.0	5.8
Mercury (inorganic)	7439-97-6					not available					2
MTBE	1634-04-4					not available					20-40
Naphthalene	91-20-3					not available					none
cPAH Mixtures	na										
Benzo[a]anthracene	56-55-3					not available					
Benzo[b]fluoranthene	205-99-2					not available					
Benzo[k]fluoranthene	207-08-9					not available					
Benzo[a]pyrene	50-32-8	0.000001	70	75	1,000	7.3	2.0	30	1	1.0	0.012
Chrysene	218-01-9					not available					
Dibenzo[a,h]anthracene	53-70-3					not available					
Indeno[1,2,3-cd]pyrene	207-08-9					not available					
(1) Source of Cancer Potency Factor is the oral slope factors from EPA's IRIS database, except for Lindane which is from HEAST.											
(2) Value calculated using equation 720-2 and default assumptions in that equation.											
(3) Maximum contaminant level from 40 CFR 141.61 & 141.62 and WAC 246-290-310 except for lead and MTBE. MTBE is an EPA Advisory range.											
Lead is the MCL goal of zero and the EPA action level from 40 CFR 141.80 for which no more than 10% of samples can exceed at the tap.											
(4) MCL divided by Method B value. Bolded values indicate MCL greater than MTCA acceptable risk of 1X10-5 [i.e. >10].											

Table 4: Drinking Water -- Method B Calculations for Carcinogens

Risk Calculations--Carcinogenic Effects of Drinking Water Ingestion														
Parameter	CAS No.	Cancer										Method B Carcinogen	MCL(3) MCL(4)	Risk @ MCL(4)
		Risk	Avg. Body Weight	Lifetime	Unit Conv.	Potency Factor	Drinking H2O Ing. Rate	Duration of Exposure	Inhalation Corr. Factor	Drinking H2O Fraction				
		(unitless)	(kg)	(years)	(ug/mg)	(kg-day/mg)	(liter/day)	(years)	(unitless)	(unitless)				
PCB mixtures	1336-36-3												0.5	
High Risk & Persistence		0.000001	70	75	1,000	2.0	2.0	30	1	1.0	0.044	0.5	11	
Low Risk & Persistence		0.000001	70	75	1,000	0.4	2.0	30	1	1.0	0.22	0.5	2.3	
Lowest Risk & Persistence		0.000001	70	75	1,000	0.07	2.0	30	1	1.0	1.25	0.5	0.40	
Aroclor 1016	12674-11-2					not available							0.5	
Arochlor 1248	12672-29-6					not available								
Arochlor 1254	11097-69-1					not available							0.5	
Arochlor 1260						not available								
Tetrachloroethylene (PCE)	127-18-4	0.000001	70	75	1,000	0.051	2.0	30	2	1.0	0.86	5	6	
Toluene	108-88-3					not available							1,000	
1,1,1 Trichloroethane	71-55-6					not available							200	
Trichloroethylene	79-01-6	0.000001	70	75	1,000	0.011	2.0	30	2	1.0	4.0	5	1.3	
Vinyl Chloride	75-01-4	0.000001	70	75	1,000	1.9	2.0	30	2	1.0	0.023	2	87	
Xylenes	1330-20-7					not available							10,000	
m-Xylene	108-38-3					not available								
o-Xylene	95-47-6					not available								
p-Xylene						not available								
Gross Alpha Particle Act.						not available							15 pCi/l	
Gross Beta Particle Act.						not available							4 mrem/yr	
Radium 226 & 228						not available							5 pCi/l	
Radium 226						not available							3 pCi/l	
(1) Source of Cancer Potency Factor is the oral slope factors from EPA's IRIS database, except for tetrachloroethylene, trichloroethylene and vinyl chloride which are from HEAST.														
(2) Value calculated using equation 720-2 and default assumptions in that equation.														
(3) Maximum contaminant level from 40 CFR 141.61 and WAC 246-290-310.														
(4) MCL divided by Method B value. Bolded values indicate MCL greater than MTCA acceptable risk of 1X10-5 [i.e. >10].														